

# PATENT ABSTRACTS OF JAPAN

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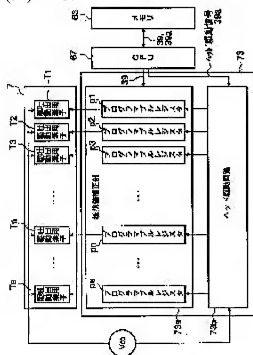
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## (54) PRINTER



(57)Abstract:

**PROBLEM TO BE SOLVED:** To provide a printer in which an image can be formed with high image quality on an object by correcting the quantity of a plurality of ink liquid drops, being ejected from a plurality of nozzle holes, to be equalized.

**SOLUTION:** The printer 5, 5a, 5b, 5c comprising a recording head 51 provided with a plurality of nozzle holes made over a length substantially corresponding to the width of an object 27 and ejecting a plurality of inks, respectively, from the plurality of nozzle holes to form a plurality of pixels on the object 27 with the plurality of inks further comprises a cartridge comprising a body, and means being fixed removably to the body and storing information 39 for correcting the quantity of a plurality of ink liquid drops wherein the body comprises means 53 for acquiring the correction information, and means 67 and 73 for controlling

driving of the cartridge 7 while taking account of the correction information 39.

## DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention breathes out ink to a subject and relates to the printer which forms the pixel which becomes the subject in ink.

[0002]

[Description of the Prior Art] Conventionally, as a typical recorder aiming at a hard copy, the recorder of an electrophotographing system, an inkjet method, wire dot matrix printing, thermal recording, and a hot printing method is known well. In these methods, an inkjet method came to be widely used from the reasons of the correspondence to wide range input methods, such as coexistence of character quality and photograph image quality, a computer, and a digital camera, the speed of print speed, the silence at the time of operation, etc.

[0003] This inkjet method is a method which makes an ink droplet breathe out toward a transferred thing from the detailed nozzle hole formed in the recording head. There are mainly a piezo method and a bubble jet (registered trademark) method. A piezo method is a method which carries out the regurgitation of the ink by operation of a piezoelectric vibration element.

Bubble Jet is a method which carries out the regurgitation of the ink with heating of ink with a heater.

Especially as for the printer which these inkjet methods have the feature that there is little noise and a miniaturization is comparatively easy, and adopts an inkjet method, market size is growing in recent years. However, it is not satisfied only with such a feature, high definition, what is called photograph image quality, and the voice of the user who asks for a more nearly high-speed print brace up a printer development engineer more, and much new art which they invented is completing the printer which can obtain the dramatically outstanding image quality of high resolution.

[0004] The improvement and improvement in the speed of the image quality of a subject which were printed are demanded in recent years, and various methods are devised from the former. In order to accept such a demand, while making smaller the ink droplet breathed out from the nozzle hole formed in the recording head, discharging timing of the drop of ink must be made more into a high speed.

[0005]

[Problem(s) to be Solved by the Invention] However, if each nozzle hole in a recording head is processed small, as shown in drawing 24 from the relation of process tolerance, an error may be produced in the path of a nozzle hole. Thus, when the regurgitation of the drop of two or more ink is carried out from each nozzle hole which produced the working error, respectively, the droplet quantity of ink will produce dispersion.

[0006] The droplet quantity of two or more ink in which a recording head is breathed out from each nozzle hole by the variation in the resistance of each heater besides the cause by the process tolerance of a nozzle hole may vary, respectively. Drawing 25 (A) - drawing 25 (C) are the figures showing an example of the resistance of each heater in the head chip of the recording head which adopts Bubble Jet, respectively. The horizontal axis in drawing 25 (A) - drawing 25 (C) is nozzle No. of each nozzle hole, respectively, and the vertical axis shows the resistance of the heater corresponding to each nozzle hole,

respectively. Drawing 25 (A) shows an example of the resistance of each heater formed in the silicon wafer before starting the above-mentioned head chip. 5000 nozzle holes shall be formed in the recording head which shows the characteristic of drawing 25 (A), for example. As it turns out that drawing 25 (A) is referred to, it turns out that the heater of each nozzle hole has remarkable variation in the resistance. If the head chip which has such a resistive characteristic is started from a silicon wafer and it uses for a recording head, though natural, the characteristic of each heater will show the same characteristic. [0007]Drawing 25 (B) shows an example of the resistance of each heater in the head chip which started more the head chip of the recording head which shows the characteristic of drawing 25 (A) to the small unit. 1000 nozzle holes shall be formed in the recording head which shows the characteristic of drawing 25 (B), for example. Here, it is assumed that five recording heads in which 1000 nozzle holes were formed, for example have arranged. Although dispersion in the resistance of these heaters is based also on the degree, when the same voltage is applied to each heater, respectively, it turns into energy dispersion, and turns into dispersion in the droplet quantity of the ink which carries out the regurgitation as a result. The droplet quantity of the ink which carries out the regurgitation, respectively varies from each nozzle hole in this way, for example, in the same pixel, in two or more ink, if it is going to acquire intermediate color in piles, dispersion will be further emphasized by the recording head using pulse width modulation.

[0008]Drawing 25 (C) shows an example of the resistance of each heater at the time of continuing using the recording head which shows the characteristic of drawing 25 (A). As for it, when drawing 25 (C) is referred to, the resistance of each heater in a recording head turns out that resistance is changing with aging etc. Change of the resistance of each heater in such a recording head will affect the droplet quantity of the ink which carries out the regurgitation as it is.

[0009]Thus, the droplet quantity of ink produces an error by the error on processing of the nozzle hole formed in a head chip, or the error of the resistance of each heater, and a recording head makes the picture printed by the subject produce unevenness.

[0010]Then, this invention cancels an aforementioned problem, it amends it so that the droplet quantity of two or more ink breathed out from two or more nozzle holes, respectively may become an equivalent amount respectively, and it aims at providing the printer which can high-definition-ize the picture formed in a subject.

[0011]

[Means for Solving the Problem]If the above-mentioned purpose is in an invention of claim 1, two or more nozzle holes are formed over length which is mostly equivalent to width of a subject, Are a printer to form two or more pixels which are provided with a recording head which carries out the regurgitation of two or more ink almost simultaneous from said two or more nozzle holes, respectively, and are formed in said subject in said two or more ink, respectively, and A main part, To said main part, it is removable and has a cartridge provided with said recording head and a memory measure which memorizes correction information for amending droplet quantity of two or more of said ink, respectively, Said main part is attained by printer provided with an acquisition means which acquires said correction information, and a control means which carries out drive controlling of said cartridge in consideration of said correction information.

[0012]According to composition of claim 1, correction information for amending droplet

quantity of two or more ink which carries out the regurgitation from each nozzle hole, respectively is provided in a cartridge. If a printer is equipped with this cartridge, an acquisition means will acquire that correction information. When a printer prints, even if it has produced an error in droplet quantity of ink which carries out the regurgitation from each nozzle hole of a cartridge, respectively, a control means amends droplet quantity of two or more ink breathed out from each nozzle hole, respectively, respectively, taking correction information into consideration. Therefore, droplet quantity of ink is amended appropriately and a pixel formed by ink reaching a subject serves as exact concentration. Since the regurgitation of the drop of two or more ink can be carried out almost simultaneously, respectively from two or more nozzle holes formed over length which is mostly equivalent to width of a subject, it becomes unnecessary to scan this printer along the cross direction of a subject. Therefore, the printer can also print a picture which becomes a subject by a pixel at high speed.

[0013]As for an invention of claim 2, in composition of claim 1, said correction information is recorded on a recording medium of said cartridge and one. If a printer is equipped [ according to composition of claim 2 ] with a cartridge in addition to an operation of claim 1, the acquisition means can acquire correction information of a cartridge. Therefore, since a cartridge and correction information are one, losing correction information of it is lost while the printer can acquire correction information of a cartridge easily.

[0014]As for said correction information, an invention of claim 3 is recorded on a recording medium of a different body with said cartridge in composition of claim 1. According to composition of claim 3, in addition to an operation of claim 1, a printer is equipped with a cartridge and an acquisition means acquires correction information used as a different body with a cartridge further.

[0015]An ink tank with which an invention of claim 4 stores in said cartridge said ink supplied to said recording head in composition of claim 1 is formed in one.

[0016]An invention of claim 5 is provided with a heater element which said recording head heats said ink and carries out the regurgitation of said ink in composition of claim 4. When a head carries out the regurgitation of the drop of ink in addition to an operation of claim 4, a heater element heats ink and makes ink breathe out according to composition of claim 5.

[0017]An invention of claim 6 is provided with a function in which said recording head carries out the regurgitation of said two or more kinds of ink, respectively, in composition of claim 1. According to composition of claim 6, drive controlling of the cartridge can be carried out, taking into consideration correction information of droplet quantity of two or more kinds of ink in which a control section is breathed out, respectively in addition to an operation of claim 1. Therefore, the printer can improve image quality also in color printing.

[0018]In composition of claim 1, said pixel is putting a drop of said ink on said subject two or more times, and reaching the target, and gray scale representation of the invention of claim 7 is carried out. According to composition of claim 7, in addition to an operation of claim 1, gray scale representation of the pixel in a picture formed in a subject is carried out correctly.

[0019]In composition of claim 7, concentration expression of the invention of claim 8 is carried out in arrangement of two or more unit pixels by which said pixel is formed in

said subject. As for an invention of claim 9, in composition of claim 7, said two or more unit pixels are formed along an arrangement direction of two or more of said nozzle holes, respectively. As for an invention of claim 10, in composition of claim 7, said two or more unit pixels are formed along a perpendicular direction of an arrangement direction of two or more of said nozzle holes, respectively. As for an invention of claim 11, in composition of claim 7, said two or more unit pixels are formed along a perpendicular direction of an arrangement direction of two or more of said nozzle holes, and an arrangement direction of two or more of said nozzle holes, respectively.

[0020]According to composition of claim 8 to claim 11, in addition to an operation of claim 7, concentration expression of the pixel formed in a subject is correctly carried out by two or more unit pixels formed in ink in which droplet quantity was correctly amended by correction information, respectively, respectively.

[0021]If the above-mentioned purpose is in an invention of claim 12, two or more nozzle holes are formed over length which is mostly equivalent to width of a subject, Are a printer to form two or more pixels which are provided with a recording head which carries out the regurgitation of two or more ink almost simultaneous from said two or more nozzle holes, respectively, and are formed in said subject in said two or more ink, respectively, and A main part, To said main part, it is removable and has a cartridge provided with said recording head and a memory measure which memorizes correction information for amending droplet quantity of two or more of said ink, respectively, Said main part is attained by printer provided with a remote acquisition means which acquires said correction information through a network, and a control means which carries out drive controlling of said cartridge in consideration of said correction information.

[0022]According to composition of claim 12, correction information for amending droplet quantity of two or more ink which carries out the regurgitation from each nozzle hole, respectively does not need to provide in a cartridge. If a printer is equipped with this cartridge, a remote acquisition means will acquire correction information corresponding to that cartridge through a network. When a printer prints, even if it has produced an error in droplet quantity of ink which carries out the regurgitation from each nozzle hole of a cartridge, respectively, a control means amends droplet quantity of two or more ink breathed out from each nozzle hole, respectively, respectively, taking correction information into consideration. Therefore, droplet quantity of ink is amended appropriately and a pixel formed by ink reaching a subject serves as exact concentration. Since the regurgitation of the drop of two or more ink can be carried out almost simultaneous, respectively from two or more nozzle holes formed over length which is mostly equivalent to width of a subject, it becomes unnecessary to scan this printer along the cross direction of a subject. Therefore, the printer can also print a picture which becomes a subject by a pixel at high speed.

[0023]

[Embodiment of the Invention]Hereafter, the suitable embodiment of this invention is described in detail based on an accompanying drawing. since the embodiment described below is a suitable example of this invention, desirable various limitation is attached technically, but the range in particular of this invention is not restricted to these gestalten, as long as there is no statement of the purport that this invention is limited in the following explanation.

[0024]1st embodiment drawing 1 is a perspective view showing an example of the

appearance of the printer 5 as a 1st embodiment of this invention. The printer 5 is a printer which prints on a recording form, for example with an inkjet method, and contains the removable head assembly 7 (cartridge) which carries out the regurgitation of the ink. This printer 5 comprises a main part which are portions other than this head assembly 7 and head assembly 7. The head assembly detaching port 31 for the case 29 of the rectangular parallelepiped making the exterior mostly, and detaching and attaching the head assembly 7 on the upper surface of the case 29 in which the printer 5 has nothing in part is formed. The outlet 25 of the recording form is formed for lacking only in the above in the tray detaching port 8a and the case 29 for detaching and attaching the tray 8 which stores in the transverse plane of the case 29 the recording form which is not illustrated. The cable 15 as a power source wire or a signal wire is formed in the rear face of the case 29.

[0025]Drawing 2 is a penetration perspective view showing the example of composition of the printer 5 in drawing 1, and drawing 3 is a penetration perspective view showing an example of signs that the head assembly 7 was removed in the printer 5 of drawing 2. The holder 33 for holding the printer 5 removable, when it equips with the head assembly 7, as shown in drawing 2 is formed. If it equips with the head assembly 7, this holder 33 will hold the head assembly 7 so that the discharge head 35 (recording head) which carries out the regurgitation of the ink in the head assembly 7 may turn to the bottom. The discharge head 35 which turned to the bottom holds some crevices on the recording form 27 (subject) fed [ paper ] to which and sent by the printer mechanism part 10 from the tray 8, and meets it. By control of a predetermined printer control part, the discharge head 35 breathes out ink to the recording form 27, and prints a predetermined character and picture. Here shows partial [ at large / structural / in the printer 5 ] in the printer mechanism part 10. For example, the paper feed part which has a feeding part which feeds paper to the recording form 27 from the tray 8, a roller which sends a recording form, etc., the discharge part which discharges the printed recording form, and the mechanism needed for operation of the printer 5 in addition to this are shown.

[0026]It being characteristic in this printer 5 is that the primary detecting element 53 (acquisition means) is formed. This primary detecting element 53 has a function which acquires the amendment data 39 (correction information) provided in the head assembly 7.

[0027]This amendment data 39 is data for amending the droplet quantity of the ink breathed out from the discharge head 35 of the head assembly 7. If it equips with the removable head assembly 7, the printer 5 can recognize this amendment data 39, and can amend the droplet quantity of ink in consideration of the amendment data 39. If it does in this way, the droplet quantity of ink becomes fixed [ the printer 5 ], and high definition-ization can be attained, without producing nonuniformity in the picture formed in the recording form 27.

[0028]Drawing 4 is an exploded perspective view showing the example of composition of the head assembly 7 of drawing 3. The ink cartridge 37 (ink tank) which stores in the head cartridge 51 (recording head) and a head cartridge the ink supplied to 51 at the head assembly 7 is formed in one. The ink cartridge 37 has an ink tank for storing the ink of at least 1 color. Specifically, the ink cartridge 37 has an ink tank of 4 classification by color of the yellow (Yellow) ink tank 37a, the ink tank 37b of magenta (Magenta), the ink tank 37c of cyanogen (Cyan), and the black (Black) ink tank 37d, for example. The ink supply

and the storage which is not illustrated for these ink tanks 37a-7d to supply each ink to the confrontation with the ink cartridge holders 49, respectively, or store it are provided. [0029]The head cartridge 51 has the lid 41, the ink cartridge holders 49, and the above-mentioned discharge head 35. The discharge head 35 has the frame 43, the head chip 47, and the plate 45. Two or more nozzle holes are formed over the length which is mostly equivalent to the width of the recording form 27, and this discharge head 35 has a function which carries out the regurgitation of two or more ink almost simultaneous from two or more of these nozzle holes, respectively. The head chip 47 comprises the 1st head chip 47a - 4th head chip 47d.

[0030]The ink cartridge holders 49 are the members in which the crevice was formed according to the ink tanks [ 37a-37d ] number, respectively so that the above-mentioned ink tanks 37a-37d can be held removable, respectively. The holes 49a-49d where ink supply and a storage of above-mentioned ink tanks [ 37a-37d ] are arranged, respectively are established in the bottom of these crevices. The lid 41 is attached so that the ink tanks [ 37a-37d ] upper surface may be covered, if the ink cartridge holders 49 are arranged [ the ink tanks 37a-37d ] in the above-mentioned crevice, respectively. That is, the ink tanks 37a-37d will be sealed, respectively.

[0031]On the other hand, the 1st head chip 47a of the above - the 4th head chip 47d are chips for having a heater element, respectively and carrying out the regurgitation of the ink of the four above-mentioned color by the drive, respectively. These the 1st head chip 47a - 4th head chip 47d are a strip-of-paper-like member, are in the state arranged so that a longitudinal direction may become parallel mutually, and are put between the plate 45 and the frame 43. The frame 43 is a plate-like member and the long and slender grooved hole which met the 1st [ about ] head chip 47a - 4th head chip [ 47d ] shape is provided. The frame 43 is attached to the undersurface of the ink cartridge holders 49. The plate 45 is a plate-like member and the nozzle hole is formed in about 1 straight line along with the 1st head chip 47a - head chip [ 4th / 47d ] shape to put.

[0032]It being characteristic in this embodiment is that the amendment data 39 is formed in the head assembly 7 as mentioned above. This amendment data 39 may be formed, for example in one place of the ink cartridge holders 49 (side 55 grade), and may be made to be attached to the head assembly 7 in the state where it was stored in the predetermined information recording medium, for example. This amendment data 39 may have an identifier for discriminating the head assembly 7 from other head assemblies 7 at least.

[0033]Drawing 5 (A) - drawing 5 (C), drawing 6 (A) - drawing 6 (C) and drawing 7 (A) - drawing 7 (B) are the perspective views showing an example of the attachment method of the amendment data 39 attached to the head assembly 7, respectively. This amendment data 39 is recorded on the recording medium of the head assembly 7 and one in the example of drawing 5 (A) - drawing 5 (C) and drawing 6 (A) - drawing 6 (C), and the head assembly 7 is recorded on the recording medium of the different body in the example of drawing 7 (A) - drawing 7 (B). In the following explanation, as for the amendment data 39, the primary detecting element 53 (detection means) of drawing 2 shall have the function to read the information at least according to the kind of amendment data 39.

[0034]It may be made for the amendment data 39 to show predetermined information by a one-dimensional bar code, as shown in drawing 5 (A), and may be made to show predetermined information by a two-dimensional dot code, as shown in drawing 5 (B).

Here, a two-dimensional dot code is an identifier the dot arranged in dispersion in a flat surface indicates predetermined information to be. If it does in this way, the amendment data 39 can hold much more information rather than the time of using the bar code shown in drawing 5 (A).

[0035]The amendment data 39 is good also as an identifier which shows predetermined information by the partial color change by a color material as shown in drawing 5 (C). If it does in this way, the amendment data 39 can give more information using the information which a color change has.

[0036]It may be made for the amendment data 39 to show predetermined information by the coding by electric contact, as shown in drawing 6 (A). That is, the amendment data 39 shown in drawing 6 (A) exposes two or more electrodes, for example, and if the primary detecting element 53 of drawing 2 chooses the portion in the inside of it through which it can be flowed, it can show two or more bits information. If it does in this way, it will become easy to distinguish the amendment data 39 to a big change of every lot of head assembly 7 grade, shape, etc. (as opposed to what changes in large quantities).

[0037]It may be made for the amendment data 39 to show the predetermined information which IC (Integrated Circuit) chip has as shown in drawing 6 (B). This IC chip has a predetermined terminal, and direct contact of it is carried out to the terminal prepared for the primary detecting element 53 of drawing 2, and it has a function which carries out the data communications of the information. If it does in this way, the amendment data 39 can hold a lot of information.

[0038]It may be made for the amendment data 39 to show predetermined information by storing in a noncontact IC chip, as shown in drawing 6 (C). That is, this noncontact IC chip has a predetermined antenna, and has a function which carries out the data communications of the information by non-contact among the primary detecting elements 53 of drawing 2. Since the primary detecting element 53 will not contact the amendment data 39 if it does in this way, the printer 5 can prevent failure by damage and can improve reliability.

[0039]Even if it does not form the amendment data 39 in one place of the head assemblies 7, it is made to hold to the memory card 56, as shown in drawing 7 (A), and it may be made to attach it to the head assembly 7. That is, the primary detecting element 53 of drawing 3 is established in the printer 5 as a drive device for memory cards, and has the function to read at least the amendment data 39 held at the memory card 56.

[0040]Even if it does not form the amendment data 39 in one place of the head assemblies 7, it makes predetermined information hold to the magnetic card 58, as shown in drawing 7 (B), and it may be made to attach it to the head assembly 7. That is, the primary detecting element 53 of drawing 3 is established in the printer 5 as a drive device for magnetic cards, and has the function to read at least the above-mentioned amendment data 39 held at the magnetic card 58.

[0041]Drawing 8 is a block diagram showing the electric example of composition of the printer 5 of drawing 1. The printer 5, RAM. (Random.) Access Memory61, ROM (Read.) It has Only Memory63, CPU(CentralProcessing Unit) 67, the head actuator 73, the head assembly 7, the head primary detecting element 75, the printer control part 77, the printer mechanism part 10, and the interface 65.

[0042]RAM61 is an information storage medium in which write-in read-out is possible, and is the workspace of CPU67 (control means). ROM63 is an information storage



medium which can be read and provides the information currently recorded on CPU67. ROM63 rewrites information. It is connected to RAM61, ROM63, the head actuator 73, the head primary detecting element 75, the printer control part 77, the printer diagnostic part 79, and the interface 65, and CPU67 controls these or acquires data from these.

[0043]The above-mentioned head actuator 73 is controlling operation of the head assembly 7 by control of CPU67. This head assembly 7 has the above-mentioned ink cartridge and a head cartridge which carries out the regurgitation of the ink. The head primary detecting element 75 detects that have a function which acquires predetermined information from the removable head assembly 7 to the printer 5, for example, the printer 5 was equipped with the head assembly 7. The head primary detecting element 75 has the above-mentioned primary detecting element 53 which detects the amendment data 39 provided in the head assembly 7.

[0044]The above-mentioned printer control part 77 controls operation of the printer mechanism part 10 by control of CPU67. This printer mechanism part 10 shows the whole mechanism for [ in the printer 5 ] printing.

[0045]The interface 65 is that a printer cable is connected, for example by Centronics, or a LAN (Local Area Network) cable is connected by a network, and is an interface for communicating the data of a picture to print etc.

[0046]Drawing 9 is a block diagram showing the partial electric example of composition of the printer 5 of drawing 8. The memory 63 stores the amendment data 39 and the head driving signal 39a which the primary detecting elements 53, such as drawing 2, detected. The head assembly 7 has the driver elements T1-Tn for regurgitation, and Te, for example for every nozzle hole. These driver elements T1-Tn for regurgitation and Te show the above-mentioned heater element which makes the drop of ink heat and breathe out. The above-mentioned head driving signal 39a is a parameter for driving the driver elements T1-Tn for regurgitation, and Te. The head actuator 73 (control means) has the head drive circuit 73b and the resistance amendment part 73a.

[0047]This resistance amendment part 73a has the programmable registers p1-pn and pe. These programmable registers p1-pn and pe store the driver elements T1-Tn for regurgitation, and the amendment data 39 of the driver element unit for amending the driving state of Te, respectively based on the amendment data 39 which CPU67 acquired from the memory 63. On the other hand, the head drive circuit 73b has a function in which CPU67 drives the driver elements T1-Tn for regurgitation, and Te based on the head driving signal 39a acquired from the memory 63. Between the head drive circuit 73b, and the driver elements T1-Tn for regurgitation and Te, the programmable registers p1-pn of the resistance amendment part 73a and pe are provided.

[0048]That it is characteristic in this embodiment takes into consideration the amendment data 39 of a driver element unit in which the head drive circuit 73b is stored in the programmable registers p1-pn and pe, respectively, It is being able to drive the driver elements T1-Tn for regurgitation, and Te based on the head driving signal 39a. Therefore, the droplet quantity of the ink breathed out from the driver elements T1-Tn for regurgitation and Te, respectively is amended so that it may become a desired quantity correctly. For this reason, the printer 5 is uniform in the picture formed in the recording form 27 of drawing 1, and can attain high definition-ization.

[0049]The printers 5 are the above composition, and they explain the example of operation, referring to drawing 1 - drawing 9 next.

Acquisition drawing 10 of amendment data is a flow chart which shows an example of the procedure in which the printer 5 acquires amendment data. In step ST1, as shown in drawing 3, the head assembly 7 is arranged in the upper part of the printer 5, and as shown in drawing 2, the holder 33 of the printer 5 is equipped with the head assembly 7. Next, in step ST2 of drawing 10, the primary detecting element 53 of drawing 2 acquires the amendment data 39, and it this amendment data 39. For example, it is stored in the memory 63 of drawing 9 which is EEPROM (Electrically Erasable and Programmable ReadOnly Memory) (step ST3 of drawing 10). Thus, the amendment data 39 is inputted into the printer 5 (step ST4 of drawing 10).

[0050]Drive drawing 11 of the discharge head in consideration of amendment data is a flow chart which shows an example of the procedure in which the printer 5 drives the discharge head 35. In step ST10, the head driving signal 39a is given to the head drive circuit 73b from CPU67 of drawing 9. Next, in step ST11 of drawing 11, CPU67 of drawing 9 acquires the amendment data 39 from the memory 63, and sends the amendment data 39 to the resistance amendment part 73a. Next, in step ST12 of drawing 11, the head drive circuit 73b of drawing 9 drives the driver elements T1-Tn for regurgitation, and Te in consideration of the amendment data 39.

[0051]Thus, although the droplet quantity of the ink breathed out from each nozzle hole of the discharge head 35, respectively is amended next, it verifies about the ability to amend [ how much ]. Drawing 12 (A) and drawing 12 (B) are the figures showing an example which measured the droplet quantity (concentration) of the ink breathed out from each nozzle hole of the discharge head 35, respectively. Drawing 12 (A) shows an example of the concentration of the ink breathed out from the discharge head in the conventional printer as comparison and contrast, and drawing 12 (B) shows an example of the concentration of the ink breathed out from the discharge head 35 in the printer 5. Such concentration is measured, for example by microdensitometer.

[0052]When drawing 12 (B) is referred to comparing with drawing 12 (A), it turns out that the droplet quantity of the ink breathed out, respectively is about 1 fixed quantity, and the discharge head 35 in the printer 5 of drawing 2 is correctly amended from a nozzle hole.

[0053]Although the droplet quantity of the ink breathed out from the nozzle hole in the discharge head 35, respectively by changing the resistance of the driver elements T1-Tn for regurgitation of drawing 9 and Te is amended in this embodiment, it is not restricted to this. The driver voltage of the driver elements T1-Tn for regurgitation and the head driving signal 39a given to Te may be made for the head drive circuit 73b of drawing 9 to change, and the driving time of the head driving signal 39a may be made to change as other correcting methods, for example.

[0054]The preparation method of the above-mentioned amendment data 39 is explained. Drawing 13 is a perspective view showing an example of the appearance of the component 87 for creating the amendment data 39. The component 87 has the computer 90, the control device 88, and the correcting part 81. The computers 90 are electronic equipment, such as what is called a personal computer. The control device 88 is connected with the computer 90 and the correcting part 81 by the cable 85 grade, respectively. The control device 88 has a function which controls operation of the correcting part 81 by the directions from the computer 90.

[0055]The correcting part 81 has the base 86, the indicating members 91 and 92, the table

80, the recording member 79, the holder 84, the primary detecting element 82, and the amendment data recording part 83. The base 86 is a plate-like member and is a portion which makes the foundation of the correcting part 81. The indicating members 91 and 92 are formed in the base 86, and they convey the table 80 conveyed in the SH direction, supporting the table 80. The recording member 79 is arranged in the surface of this table 80. The drop of the ink which breathed out this recording member 79 from the discharge head of the head assembly 7 reaches the target. The holder 84 is a member for holding the head assembly 7. The primary detecting element 82 detects the droplet quantity (concentration) of the ink which reached the recorded media 79. The amendment data recording part 83 has a function attached by recording the amendment data 39 on the head assembly 7 about the droplet quantity etc. of the ink which the primary detecting element 82 detected.

[0056]The calibrating apparatus 87 are the above composition, and they explain the example (preparation method of amendment data) of the component 87 of operation, referring to drawing 13 next. Drawing 14 is a flow chart which shows an example which attaches the amendment data 39 to the head assembly 7 with the calibrating apparatus 87 of drawing 13. First, as for the calibrating apparatus 87 of drawing 13, the holder 84 is equipped with the head assembly 7. It may be made for the amendment data recording part 83 to read the identifier of the head assembly 7 in this state.

[0057]Next, in step ST22, the calibrating apparatus 87 measures the resistance of the driver elements T1-Tn for regurgitation of drawing 9 of each nozzle in the discharge head of the head assembly 7, and Te. Next, in step ST23 of drawing 14, the calibrating apparatus 87 detects the measured driver elements T1-Tn for regurgitation, and the maximum resistance Rmax of the resistance of Te. Here, the resistance of the driver elements T1-Tn for regurgitation of each nozzle and Te is set to R1-Rn, and Re, respectively. Next, amendment data is created in step ST24 of drawing 14. First, a formula (1) will be materialized if it is made for driving energy (execution energy) for the driver element Tn for regurgitation of resistance Rn to drive to become uniform at the driver elements T1-Tn for regurgitation of each nozzle, and Te. "rn" in a formula (1) shows the amendment data of resistance.

[0058]  
$$1/R_{max}=R_n/(R_n+r_n)^2 \dots (1)$$

[0059]Therefore, the amendment data of resistance is called for like a formula (2).  
$$r_n=(R_{max}R_n)^{1/2}-R_n \dots (2)$$

[0060]Thus, if the amendment data 39 of resistance (rn) for which it asked is added to the driver elements T1-Tn for regurgitation of each nozzle, the resistance R1-Rn of Te, and Re, respectively, the driving energy of each heater in a discharge head will become uniform.

[0061]Next, in step ST25 of drawing 14, ink is breathed out after amendment. And in step ST26, the concentration of the dot formed in the recording member 79 in ink is measured. In step ST27, it is judged whether the concentration of the measured ink is contained in the reference value. If the droplet quantity (concentration) of the measured ink is contained in the reference value, the amendment data recording part 83 is attached by recording the amendment data 39 on the head assembly 7 (step ST28). On the other hand, if the droplet quantity of the measured ink is not contained in the reference value, the driver element for regurgitation with much droplet quantity lowers the amendment

data rn of resistance, for example, and, as for the driver element for regurgitation with little droplet quantity, the amendment data rn of resistance is raised. And it returns to step ST25, and measurement is performed, and again, amendment and measurement are repeated until it becomes in a reference value.

[0062]In using for a discharge head a head chip which the regurgitation variation there is much variation, such as wiring resistance at the time of a drive and switching resistance, and according to it generates, The amendment data rn of resistance is tuned further finely after measuring the concentration of the droplet quantity of ink preferably, and it may be made to equalize concentration.

[0063]According to a 1st embodiment of this invention, it can amend so that the droplet quantity of two or more ink breathed out from each nozzle hole may become almost an equivalent amount respectively, and high definition-ization of the picture formed in the subject of recording form 27 grade can be attained. Thus, even if it is the head assembly 7 from which the droplet quantity of the ink breathed out from each nozzle hole differs, the droplet quantity of the ink breathed out from each nozzle hole is amended and equalized. For this reason, even if it equips arbitrary printers with the head assembly 7, the printer 5 can make droplet quantity of the ink breathed out from each nozzle hole, respectively almost an equivalent amount, and can attain high definition-ization uniform. Therefore, since it can amend the droplet quantity of the ink which carries out the regurgitation even if arbitrary printers are equipped with such a head assembly 7, it becomes easy to be able to use about repeatedly and to recycle. If a discharge head is provided with two or more nozzle holes formed over the length which is mostly equivalent to the width of the recording form 27, since it can print by scanning once to the recording form 27, a discharge head can be printed at high speed.

[0064]Since the printer 5a as a 2nd embodiment of a 2nd embodiment is the almost same composition as the printer 5 as a 1st embodiment in drawing 14 from drawing 1, the same composition explains a different point as a center using the numerals in drawing 14 from drawing 1. Drawing 15 is a block diagram showing the modification of the electric composition of the printer 5a as a 2nd embodiment. Although the printer 5a is the same as that of the electric composition of the printer 5 of drawing 8 in a 1st embodiment almost, it has the communication control part 69 (remote acquisition means) and the modem 71 (remote acquisition means), and differs in that the recording medium etc. with which the amendment data 39 was recorded on the head assembly 7 are not formed. The communication control part 69 is controlling by control of CPU67 the modem 71 which communicates carrying out data conversion with a digital signal and an analog signal. This modem 71 is connected to networks, such as the Internet, via the telephone line etc. A gestalt which performs direct communication with digital data may be sufficient as the communication control part 69, without passing analog data, for example by what is called LAN connection. In such a case, the modem 71 becomes unnecessary, instead the interface of a network card etc. is needed.

[0065]This printer 5a can acquire the amendment data 39 by data communications through a network. As a concrete acquisition method, the printer 5a reads the above-mentioned identifier (ID:IDentification) of the head assembly 7 in the primary detecting element 53, for example, and transmits to the predetermined amendment data supplying means which does not illustrate this identifier through a network. The function in which the primary detecting element 53 acquires the amendment data 39 like a 1st embodiment

is not needed. In the amendment data supplying means, the amendment data 39 is managed every head assembly 7, and it has a function which acquires the amendment data 39 by using the identifier of the head assembly 7 as a search key, and is supplied to the printer 5a through a network.

[0066] While being able to demonstrate the almost same effect as a 1st embodiment according to a 2nd embodiment of this invention, In addition, if it is not necessary to form the amendment data 39 in the head assembly 7 and the printer 5a is equipped with the head assembly 7, the primary detecting element 53 can acquire the amendment data 39 corresponding to the head assembly 7 through a network.

[0067] Since the printer 5b as a 3rd embodiment of a 3rd embodiment is the respectively almost same composition as the printer 5 as a 1st embodiment, and the printer 5a as a 2nd embodiment in drawing 1 - drawing 15, the same composition explains a different point as a center using drawing 1 - the numerals in drawing 15. The point of performing gray scale representation of the pixel which forms a pixel in piles and forms the drop of two or more ink in the recording form 27 in the printer 5b using pulse width modulation (PNM: Pulse Number Modulation) is a different point from the printers 5 and 5a of a 1st embodiment.

[0068] Drawing 16 and drawing 17 are the figures showing an example of the concentration at the time of forming a pixel in piles and carrying out gray scale representation of the drop of two or more ink, respectively. Drawing 16 shows the case where a pixel is formed to the recording form 27, with the printer 5b, and drawing 17 shows the case where a pixel is formed in the recording form 27 with the conventional printer. The printer 5b forms 1 pixel by piling up the drop of eight drops of ink, for example. The droplet quantity of the printer 5b of the ink breathed out from each nozzle hole is mostly fixed from the 1st drop to the 8th drop so that it may turn out that drawing 16 is referred to comparing with drawing 17. Therefore, it is stabilized on the recording form 27 which the drop of two or more ink reaches, the multi-tone of a pixel is obtained, there is no density unevenness of a picture in it, and the picture of high image quality is printed.

[0069] According to a 3rd embodiment of this invention, while being able to demonstrate the almost same effect as a 1st embodiment, the pixel formed in the recording form 2 can be expressed with multi-tone high-definition.

[0070] Since the printer 5c as a 4th embodiment of a 4th embodiment is the almost same composition as the printer 5b as a 3rd embodiment in drawing 1 - drawing 17, the same composition explains a different point as a center using drawing 1 - the numerals in drawing 17. In the printer 5c, the point of adopting a concentration modulation method is a different point from the printer 5b of a 3rd embodiment. This concentration modulation method is a method which carries out the multiple arrays of the small unit pixel to the field which should form 1 pixel, and expresses the concentration of a pixel by area gradation. The concentration expression of this pixel may be made to be carried out by the arrangement of the unit pixel shown in drawing 18 - drawing 20, respectively.

[0071] Drawing 18 is an example of signs that made the longitudinal direction of the discharge head arrange unit pixel TG on the recording form 27, and the pixel G was formed a shown top view, and drawing 19. Are an example of signs that made the recording form 27 arrange unit pixel TG to the perpendicular direction of the longitudinal direction of a discharge head, and the pixel G was formed a shown top view, and drawing

20, It is a top view showing an example of signs that made the longitudinal direction of a discharge head, and the perpendicular direction of the longitudinal direction arrange unit pixel TG, respectively, and the pixel G was formed on the recording form 27. The "longitudinal direction of the discharge head" here shows the arrangement direction (cross direction of the recording form 27) of two or more nozzle holes formed in the discharge head.

[0072]The gradation of  $N \times L$  will be obtained if the pixel G shown in drawing 18 sets to L the pixel number which arranges a gradation number to the longitudinal direction of N and a discharge head. However, the resolution of the longitudinal direction of a discharge head is set to  $1/L$ . A picture serves as high definition, so that this resolution is small.

[0073]The gradation of  $N \times M$  will be obtained if the pixel G shown in drawing 19 sets to M the pixel number which arranges a gradation number to the perpendicular direction of the longitudinal direction of N and a discharge head. However, the resolution of the longitudinal direction of a discharge head is set to  $1/M$ .

[0074]The gradation of  $N \times L \times M'$  will be obtained, if the pixel G shown in drawing 20 makes L' the pixel number which arranges a gradation number to the longitudinal direction of N and a discharge head and the pixel number arranged to the perpendicular direction of the longitudinal direction of a discharge head is made into M'. However, the resolution of the longitudinal direction of a discharge head becomes  $1/M'$ .

[0075]Drawing 21 is a figure showing an example of the characteristic of concentration to the gradation which the pixel G shown in drawing 18 shows, drawing 22 is a figure showing an example of the characteristic of concentration to the gradation which the pixel G shown in drawing 19 shows, and drawing 23 is a figure showing an example of the characteristic of concentration to the gradation which the pixel G shown in drawing 20 shows. In the characteristic of drawing 21, and the characteristic of drawing 22, although a difference is seldom seen, in the characteristic of drawing 23, it turns out that concentration has come out also with the same gradation and density characteristics are good [ the characteristic of drawing 21, and the characteristic of drawing 22 / respectively ].

[0076]While being able to demonstrate the almost same effect as a 1st embodiment according to a 4th embodiment of this invention, the pixel formed in the recording form 27, Concentration expression is correctly carried out by two or more unit pixel TG formed in the ink in which droplet quantity was correctly amended by the amendment data 39, respectively. According to a 4th embodiment, smoother gradation can be obtained although the resolution of the pixel G falls a little.

[0077]By the way, this invention is not limited to the embodiment mentioned above. The head assembly 7 in the above-mentioned embodiment may have a function which carries out the regurgitation not only of two or more kinds of ink but the monochrome ink. At the above-mentioned embodiment, although the case where it prints to the subject of a rectangle like the recording form 27 is illustrated, it cannot be overemphasized that it may be a subject of the shape of not only this but a round shape or others. Although the recording form 27 is moving in the above-mentioned embodiment to the fixed head assembly which has the discharge head 35, it cannot be overemphasized that it may be made for the discharge head 3 to move to the fixed recording form 27. Each composition of the above-mentioned embodiment can omit the part, or it can combine it arbitrarily so that it may differ from the above.

[0078]

[Effect of the Invention]As explained above, according to this invention, it can amend so that the droplet quantity of two or more ink breathed out from two or more nozzle holes, respectively may become an equivalent amount respectively, and the printer which can high-definition-ize the picture formed in a subject can be provided.

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## CLAIMS

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[Claim(s)]

[Claim 1]Two or more nozzle holes are formed over length which is mostly equivalent to width of a subject characterized by comprising the following, A printer which forms two or more pixels which are provided with a recording head which carries out the regurgitation of two or more ink almost simultaneous from said two or more nozzle holes, respectively, and are formed in said subject in said two or more ink, respectively.

A main part.

To said main part, it is removable and is said recording head.

An acquisition means which is provided with a cartridge provided with a memory measure which memorizes correction information for amending droplet quantity of two or more of said ink, respectively and from which said main part acquires said correction information.

A control means which carries out drive controlling of said cartridge in consideration of said correction information.

[Claim 2]The printer according to claim 1, wherein said correction information is recorded on a recording medium of said cartridge and one.

[Claim 3]The printer according to claim 1, wherein said correction information is recorded on a recording medium of a different body with said cartridge.

[Claim 4]The printer according to claim 1, wherein an ink tank which stores in said cartridge said ink supplied to said recording head is formed in one.

[Claim 5]The printer according to claim 4, wherein said recording head is provided with a heater element which heats said ink and carries out the regurgitation of said ink.

[Claim 6]The printer according to claim 1, wherein said recording head is provided with a function which carries out the regurgitation of said two or more kinds of ink, respectively.

[Claim 7]The printer according to claim 1 which said pixel is putting a drop of said ink on said subject two or more times, and reaching the target, and is characterized by carrying out gray scale representation.

[Claim 8]The printer according to claim 7, wherein concentration expression of said pixel is carried out in arrangement of two or more unit pixels formed in said subject.

[Claim 9]The printer according to claim 7, wherein said two or more unit pixels are formed along an arrangement direction of two or more of said nozzle holes, respectively.

[Claim 10]The printer according to claim 7, wherein said two or more unit pixels are formed along a perpendicular direction of an arrangement direction of two or more of said nozzle holes, respectively.

[Claim 11]The printer according to claim 7, wherein said two or more unit pixels are

formed along a perpendicular direction of an arrangement direction of two or more of said nozzle holes, and an arrangement direction of two or more of said nozzle holes, respectively.

[Claim 12] Two or more nozzle holes are formed over length which is mostly equivalent to width of a subject characterized by comprising the following, A printer which forms two or more pixels which are provided with a recording head which carries out the regurgitation of two or more ink almost simultaneous from said two or more nozzle holes, respectively, and are formed in said subject in said two or more ink, respectively.

A main part.

To said main part, it is removable and is said recording head.

A remote acquisition means which is provided with a cartridge provided with a memory measure which memorizes correction information for amending droplet quantity of two or more of said ink, respectively and from which said main part acquires said correction information through a network.

A control means which carries out drive controlling of said cartridge in consideration of said correction information.